

has been demonstrated that amateurs can share effectively with Government radio services, particularly radiolocation. There are practical problems sharing bands with services having relatively high transmitter power, high number of stations in heavily populated areas, and/or high duty cycle. Given the choice of no allocation or sharing with other services, a shared allocation is strongly preferred.

19. The amateur service seeks a new, shared allocation in the vicinity of 190 kHz, such as the band 160-190 kHz. At the present time, there is no allocation to the amateur service in the low frequency (LF) band. There is considerable interest in propagation and antenna experimentation in this band. This work would be facilitated by a formal allocation. Experimenters in the U.S. presently operate in this band under Part 15 of the FCC Rules, which limits total input power to the final RF stage to one watt.⁶

20. The amateur service allocations in the band 1,800-2,000 kHz should be retained. In the United States, the amateur service has a 100 kHz exclusive allocation in the band 1,800-1,900 kHz and an allocation in the band 1,900-2,000 kHz secondary to the radiolocation service.⁷ This band presently is the lowest frequency amateur service allocation, and is the only medium frequency (MF) band available to the amateur service. Its propagation characteristics allow near vertical incidence

⁶ 47 CFR §15.217.

⁷ 47 CFR §2.106, footnote US290.

communications during daytime hours and long range communications at night. This band is particularly useful during solar cycle minima, when maximum usable frequency (MUF) on paths is below 3.5 MHz.

21. The amateur service requires a common worldwide exclusive allocation of at least 300 kHz in the band 3,500-4,000 kHz and retention of present additional shared allocations in Regions 2 and 3. This band is used extensively for paths up to 500 km during the day, and for longer distances of such as 2000 km at night. In many countries, it is heavily populated with nets of amateur stations which provide training for emergency communications during natural disasters. For actual emergency communications, it is one of the bands used by stations operating under provisions of ITU Resolution 640 (WARC-79).

22. A new narrow, shared allocation is sought in the vicinity of 5 MHz. Based on the recommendation of the 1978 CCIR Special Preparatory Meeting, the 1979 World Administrative Radio Conference accepted the principle that, like other high frequency (HF) radio services, the amateur service should have access to a family of frequency bands so communications can be maintained as propagation conditions change. New exclusive allocations were added in the vicinity of 18 and 25 MHz, and a new secondary allocation was added in the vicinity of 10 MHz to bridge the gap between the bands then in existence. Particularly in the higher latitudes, there are many situations wherein the MUF is below 7 MHz and the lowest usable frequency (LUF) is above the next lower amateur service allocation

the upper limit of which is 3,800 or 4,000 kHz, depending upon the Region. Also, as amateur communication increasingly uses digital rather than analog modes of emission, inter-symbol interference (ISI) caused by multipath propagation becomes a more important factor and necessitates the use of an operating frequency as near as possible to the MUF.⁸

23. The amateur service seeks a 300 kHz wide, exclusive, worldwide allocation in the vicinity of 7 MHz. As the only primary allocation to the amateur service between 4 and 14 MHz, the 7 MHz band is in heavy use 24 hours each day. During daylight hours, the band carries the bulk of amateur sky wave communication over distances of less than 1300 km. During the winter and during periods of low solar activity, and at other times when the MUF falls below 10 MHz, it must support the bulk of amateur inter-continental communications at night. As such, the amateur service is heavily dependent upon the 7 MHz band during natural disasters. A 300 kHz exclusive worldwide amateur allocation is required to ensure effective communications in the event of natural disasters. The current estimate is that 201,000 U.S. amateur stations use the 7 MHz band.

24. Before the 1938 Cairo Conference, the 7 MHz band was 300 kHz wide. At Cairo and subsequent Conferences, the top 200 kHz of this band (7,100-7,200 kHz) was reallocated to the broadcasting service in Regions 1 and 3. The requirement for 300 kHz is being

⁸ Salaman, "A New Ionospheric Multipath Reduction Factor (MRF)", *IRE Trans. on Com. Sys.*, June 1962.

met only in Region 2 and certain countries in Regions 1 and 3 which permit their amateur stations to operate in the band 7,100-7,300 kHz under Radio Regulation 342, and then only at those times (mostly daylight hours) when broadcasting interference does not preclude full use of the band by amateur stations. In most countries in Regions 1 and 3, however, amateur stations are limited to the band 7,000-7,100 kHz, which is allocated to the amateur service exclusively, worldwide.

25. The regional difference in the 7 MHz allocations was the subject of discussions at WARC-92 and resulted in a Recommendation for a future world radiocommunication conference to consider aligning these allocations.⁹ This could be accomplished, as proposed by the United States at WARC-92, by providing a worldwide allocation of 6900-7200 kHz at a future competent world radiocommunication conference.

26. The amateur service seeks expansion of the present secondary allocation of 10,100-10,150 kHz to a primary allocation of 250 kHz bandwidth. The band 10,100-10,150 kHz was newly allocated to the amateur service at WARC-79, on a secondary basis. It is the only amateur service HF band allocated on a secondary basis. Despite its secondary status, this band is recognized in RR 510 as one of the bands used in the event of natural disasters. The amateur service has been exceedingly careful to provide

⁹ See Recommendation COM4/C, the World Administrative Radio Conference for Dealing with Certain Parts of the Spectrum (Malaga-Torremolinos, 1992).

protection to the fixed service, which has the same allocation on a primary basis. Harmful interference has been minimized by limiting transmitter power, discouraging competitive activities and by avoiding radiotelephone operation, which might cause congestion. The requirements of the amateur service would best be met by a primary allocation of 250 kHz bandwidth, such as the band 10,100-10,350 kHz. This bandwidth is needed to handle the overflow from the 7 and 14 MHz bands when they are saturated at peak operating times.

27. The growth of the amateur service and its heavy dependence on this band for international communication justifies a return to an allocation of 14,000-14,400 kHz. This band is undoubtedly the most popular amateur band for international communications over the entire solar cycle. The current estimate is that 213,000 United States amateur stations use the 14 MHz band. At the Washington Conference of 1927, this allocation was established at 14,000-14,400 kHz, but at the Atlantic City Conference of 1947, it was reduced by 50 kHz to 14,000-14,350 kHz. In recent years, amateurs in their voluntary band planning have found it increasingly difficult to accommodate the newer digital modes within the existing 14 MHz allocation, which is 14,000-14,350 kHz with a number of countries allocating the top 100 kHz to the fixed service on a primary basis.¹⁰

¹⁰ ITU Radio Regulations 535.

28. The growing needs of the amateur service would best be addressed by an exclusive allocation of 250 kHz at 18 MHz. The band 18,068-18,168 kHz was allocated to the amateur service at WARC-79. It has proven to be very popular with amateur stations wishing to avoid the congestion in the 14 MHz band. Monitoring indicates that amateur service utilization of this band is higher than that of adjacent bands by other services.

29. Retention of the band 21,000-21,450 kHz by the amateur service is essential. This is an important allocation which is congested during daylight hours when MUFs exceed 21 MHz.

30. The needs of the amateur service would be best served by widening the band 24,890-24,990 kHz to a 250 kHz bandwidth. The band 24,890-24,990 MHz was allocated to the amateur service at WARC-79. It has proven to be very popular with amateur operators, particularly when the MUF is below 28 MHz. Monitoring indicates that amateur utilization of this band is higher than that of adjacent bands by other services.

31. Retention of the band 28-29.7 MHz is essential to the amateur services. This allocation is extensively used for both terrestrial and satellite communications and is extremely important for absorbing growth in HF amateur service activity. Modes that cannot be accommodated on lower frequency bands owing to their inherent bandwidths can be accommodated here. For example, the band 29.3-29.51 MHz is reserved for satellite use within the amateur service voluntary band plans, giving amateur stations throughout the world easy access to satellite communications.

32. The amateur service could make effective use of a narrow band of frequencies between 30 and 50 MHz. This is a difficult part of the radio spectrum for fixed and mobile services to use. While it can provide good local area coverage, long distance interference degrades communications reliability and predictability. The amateur service is uniquely able to cope with propagation vagaries found in the VHF low band, by turning a fault into a feature. A band between 30 and 50 MHz would help reduce congestion of the 28 MHz band and offer an opportunity for exploiting propagation characteristics.

33. The amateur service requires retention of the band 50-54 MHz where it now exists and provision of an allocation of at least 2 MHz bandwidth in other geographical areas, with at least 500 kHz on an exclusive basis. This band is used for local amateur communication around the clock, including telecommand of model aircraft. Tropospheric scatter, sporadic-E and occasional F-layer propagation at sunspot maxima are used for longer distances. This band is also used for auroral scatter at higher latitudes. The band is ideally suited to meteor scatter using data communications (packet radio) systems, and voice communications has proven useful during meteor showers. This band is allocated to the amateur service in Regions 2 and 3, and in some countries in Region 1. It was formerly occupied by the broadcasting service (television) and phased out because of its propagation characteristics--an anathema to TV, a boon to the amateur service.

34. The amateur and amateur-satellite services seek retention of the band 144-146 MHz as a worldwide exclusive allocation with elimination of existing footnotes that allow operation by other services in some countries, and retention of the band 146-148 MHz in Regions 2 and 3. The 144 MHz allocation is heavily used by amateur stations throughout the world. The band supports extensive terrestrial voice and data relay systems as well as low Earth orbit satellites. In many of the more populous areas, occupancy is so heavy that additional stations and new uses of the band cannot be accommodated satisfactorily. Experimentation such as Earth Moon Earth (EME) communication is popular in this band because of the relatively low natural and man-made noise levels, and the ease with which sensitive receiving equipment can be acquired and maintained. The smaller allocation of 144-146 MHz in Region 1 is inadequate particularly in Europe, where there are high concentrations of amateurs. The United States is urged to support increasing the 2 meter band allocation to 144-148 MHz in Region 1 at a future world radiocommunication conference.

35. In the United States, retention of the band 222-225 MHz and additional access in part of the band 216-220 MHz is vital to the amateur service. This band has propagation characteristics similar to those of the 144 MHz band and provides for operations that cannot be accommodated in that band. Some characteristics are unique: for example, amateurs have observed the only recorded instances of sporadic-E propagation at this frequency. While the amateur service had been allocated the entire band 220-225 MHz, the

band 220-222 MHz was reallocated from the amateur service to the mobile service.¹¹ The result of this reallocation was compression of the existing users of the band from 5 MHz to 3 MHz. Not all uses could be reaccommodated within the remaining band or in another band. Spectrum for high speed packet radio was the primary loss, and at the invitation of the FCC, the League has petitioned the FCC for secondary access to part of the band 216-220 MHz.¹²

36. The amateur services require the establishment of 430-440 MHz as a worldwide exclusive band, with continued sharing of 420-430 MHz and 440-450 MHz where now permitted. In addition, deletion from the Radio Regulations of footnotes for fixed and mobile in some countries in the band 430-440 MHz is sought. This band is particularly important to the amateur services. It is the lowest frequency band in which amateurs can use conventional television (C3F emission), and other emissions with similar bandwidths. This band provides reliable local voice and data communication while at the same time affording opportunities for experimentation with various forms of tropospheric propagation and with Earth-Moon-Earth (EME) communication. Weak signal experiments are conducted on frequencies around 432 MHz throughout the world.

¹¹ See the *FCC Report and Order*, 3 FCC Rcd. 5287 (1988); affirmed on reconsideration by *Memorandum Opinion and Order*, 4 FCC Rcd. 6407, review denied sub nom. *American Radio Relay League, Incorporated v. FCC*, No. 89-1602 (D.C. Cir. Dec. 3, 1990).

¹² See RM-7747, filed by the League at FCC June 4, 1991. Though now more than 15 months old, no action has been taken thereon by FCC other than to accept comments on the petition by public notice and to accord the same a file number.

The amateur-satellite relies heavily on the band 435-438 MHz, which presently is the only space-to-Earth amateur-satellite service allocation between 146 MHz and 2.4 GHz.¹³ As a result, the band 435-438 MHz is used for the majority of past, present and future amateur satellites. Frequencies around 432 MHz and 435-438 MHz should be protected from incompatible sharing.

37. The Interdepartment Radio Advisory Committee (IRAC) has decided to move wind profiler radars to a center frequency of 449 MHz. This move could adversely affect numerous amateur radio repeaters operating within the band 448-450 MHz if sites are selected without regard to interference to amateur repeaters. Continued cooperation will be required between the Department of Commerce (specifically NTIA and NOAA) and the amateur community to avoid harmful interference between these two applications.

38. The amateur service seeks continued access to the band 902-928 MHz, with the band 902-903 MHz as primary and the band 903-928 MHz as secondary. This band is allocated to the amateur service on a secondary basis. It is useful to the amateur service despite its being an ISM band, and being shared with automatic vehicle monitoring (AVM) and low power (Part 15) devices.

39. The amateur service seeks retention of the band 1240-1300 MHz, with the band 1260-1300 MHz upgraded to primary status. The amateur-satellite service seeks removal of the directional "Earth-to-space only" restriction to permit downlinks in the band 1260-

¹³ Radio Regulations No. 664.

1270 MHz. The band 1240-1300 MHz is experiencing rapid growth for all modes, including voice repeaters, packet radio, amateur television and satellites. The use of the amateur-satellite band 1260-1270 MHz is limited to the Earth-to-space direction. The flexibility of this allocation would be greatly enhanced if this allocation were made bidirectional at a future world radiocommunication conference.

40. The amateur service seeks continued access to the band 2300-2450 MHz, with the band 2390-2450 MHz as primary status. The amateur-satellite service seeks continued access to the band 2400-2450 MHz with expansion downward to 2390-2450 MHz. From an international viewpoint, the band 2300-2450 MHz deserves some special concern. The amateur service has a secondary allocation in this band in all three Regions, and the amateur-satellite service has an allocation in the upper part of the band of 2400-2450 MHz.¹⁴ Domestically, the United States reallocated the band 2310-2390 MHz for aeronautical test telemetry.¹⁵ WARC-92 reallocated the band 2310-2360 MHz to broadcasting-satellite (sound) while retaining the band 2360-2390 MHz for aeronautical test telemetry. While the bands 2300-2310 MHz and 2390-2450 MHz are adequate for amateur service applications, and the band 2400-2450 MHz is adequate for the amateur-satellite service, domestic decisions of other

¹⁴ *Id.*

¹⁵ See the Second Report and Order in FCC Docket 80-739, FCC 83-511, 49 Fed. Reg. 2358, et. seq., released December 8, 1983.

countries have complicated the picture by allocating different segments of the band to the amateur service. The segments allocated to the amateur service may become less harmonious as Region 1 countries upgrade the mobile services to primary as a result of WARC-92.

41. The amateur service seeks retention of its secondary allocation in the band 3300-3500 MHz with consideration given to upgrading the band 3400-3420 MHz to primary status. The amateur-satellite service seeks retention of the band 3400-3410 MHz with extension of that allocation to Region 1. The amateur-satellite allocation of 3400-3410 MHz is limited to Regions 2 and 3.¹⁶ It would be helpful to have the limitations on these allocations removed at a future world radiocommunication conference.

42. The amateur service seeks retention of its existing secondary allocation in the band 5650-5925 MHz and upgrading of the band 5760-5762 MHz or 5668-5670 MHz to primary status. The amateur-satellite service seeks retention of the band 5650-5670 MHz in the Earth-to-space direction and 5830-5850 MHz in the space-to-Earth direction.

43. The amateur services seek to retain their allocations in the band 10-10.5 GHz, with the band 10.45-10.5 GHz upgraded to primary status.

44. The existing allocations to the amateur services in bands above 24 GHz should be retained. If any new ISM bands are created,

¹⁶ Radio Regulations, No. 664.

the amateur services seek shared use of such bands. In the 24 GHz band, consideration should also be given to shifting the ISM center frequency from 24.125 to 24.15 GHz and making the ISM band 200 MHz wide instead of 250 MHz, to clear the band 24-24.05 GHz for amateur development.

VI. FUTURE SPECTRUM USES

45. For decades, there have been predictions of the demise of Morse code in the amateur services. This mode requires operators proficient in Morse code, who exist in large numbers in the amateur services, irrespective of the introduction of a codeless license class. If there is any reduction in the use of Morse code, it will be gradual and long term, and the frequencies now used for this mode will certainly be used for newer data communications modes.

46. Present single-sideband, FM voice and image communication (facsimile, freeze frame and motion television) is expected to be overtaken by digital voice techniques. The benefits will be better quality and reliability rather than reduction in bandwidth requirements.

47. The continuing growth of the amateur services will necessitate greater use of higher frequencies as the lower frequencies become saturated. The line-of-sight characteristics of microwave and millimetric waves makes it necessary to employ radio relay, both terrestrial and satellite.

48. The amateur-satellite service is currently building a new satellite system, temporarily named "Phase 3D," which will have the

ability of using any and all amateur-satellite allocations from 29 MHz through 24 GHz. Separate transmitters and receivers will be designed for operation in each amateur-satellite band and can be cross-connected by computer telecommand to provide uplink/downlink pairs on any bands. Because of crowding of the bands below 2 GHz, amateur satellites will make increasing use of bands above that frequency.

49. The League has commissioned a Future Systems Committee to assess new technologies in the 5 to 15 year time frame. The committee is monitoring similar work being done by CCIR Task Group 8/1 (Future Public Land Mobile Telecommunications Systems), Association of Police Communications Officers (APCO) Project 25, and others.

VII. CONCLUSIONS

50. The amateur and amateur-satellite services continue to fulfill their mandates, as defined in the international Radio Regulations and in the FCC Rules and Regulations. The amateur services are growing at a healthy rate and are giving current attention to future systems.

51. The amateur services have allocations throughout the radio spectrum so as to provide different types of radiowave propagation. Overall, these allocations are adequate but could be improved by some additional bandwidth in a few bands, as noted above, worldwide harmonization of others and eliminating directionality in some amateur-satellite bands. Of these possible

modifications to amateur allocations, action to harmonize the 7 MHz band has already been recommended for a future world radiocommunication conference.

52. In the possible reallocation of certain Government bands to non-Government use, NTIA should be mindful of the amateur services' sharing of certain bands. Any modifications in Government primary allocations should either leave the amateur secondary allocations unchanged or provide alternative spectrum.

53. The League appreciates NTIA's initiative in studying future spectrum requirements and for the opportunity to comment in these proceedings.

Respectfully submitted,

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